Age differences of wing shape in waders

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Populations of birds with long-distance migrations are known to have more pointed wings than those with less distant migrations (Seebohm's rule). In addition, for certain bird groups, the phenomenon of age changes in wing shape is known, but has not previously been examined in waders. Investigations were made on Lapwing *Vanellus vanellus*, Oystercatcher *Haematopus ostralegus* and Dunlin *Calidris alpina*. It was found that in all these species young birds have a greater wing pointedness index than old birds. Changes in wing shape occur only after the first complete moult, and not after later moults. Differences in the wing-pointedness in young and adult birds reflect various strategies in the use of flying apparatus by birds of different age groups. More pointed wings allow a young bird to migrate further with less energy expenditure. Such longer distance migration is known, for example, in young Lapwings (Dobrynina 1985).

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Известно, что у птичьих популяций, имеющих дальние миграции, крылья более острые чем у тех, кто имеет менее протяженные перелеты (правило Сибома). Более того, для некоторых групп птиц известен феномен возрастных изменений в форме крыла, чего еще не было прослежено у куликов. Исследования проводились на чибисе *Vanellus vanellus*, кулике-сороке *Haematopus ostralegus* и чернозобике *Calidris alpina*. Было установлено, что у всех видов молодые птицы имеют больший индекс остроты крыла, чем взрослые. Изменения в форме крыла происходят только после первой полной линьки а не после более поздних линек. Различия в остроте крыла у молодых и взрослых птиц отражают разные стратегии использования полетного аппарата птицами разных возрастных групп. Имея более острые крылья, птица может совершить более протяженные миграции одновременно с меньшим утратом энергии. Такая более протяженная миграция известна, например, у молодых чибисов (Добрынина, 1985).

Introduction

Populations of birds with long distance migrations generally have more pointed wings than those making short distance migrations (Seebohm's rule, Potapov 1967). Analysis of the degree of wing pointedness can be used to help determine to which population a migrating bird belongs. Some bird groups also have age-related changes in their wing shape (Goroshko *et al.* 1992; Kozlova 1946; Yudin 1950; Tsvelikh 1989; Tsvelikh & Dyadicheva 1986; Tsvelikh & Goroshko 1991). The scale of these age differences can be greater than the differences between the populations and so could make interpretation of populations using wing pointedness more difficult. Until now, such investigations of waders have not been carried out. We have studied the wing shape of three species of waders that differ significantly in biology and body size: Dunlin *Calidris alpina*, Lapwing *Vanellus vanellus* and Oystercatcher *Haematopus ostralegus*.

Materials

Tsvelikh's (1983) index was used to estimate the degree of wing pointedness. The index was calculated as the difference in the length of the tenth and eighth primary, measured from the wing bend, divided by the length of the ninth primary and then expressed as a percentage. The birds were aged using characteristics given by Prater *et al.* (1977). Dunlin were trapped during autumn migration in September-October 1987-1988 at the Chongar station of the Azov-Black Sea Ornithological Station (northern Crimea: 45°58'N, 34°34'E). Birds caught there during spring migration (May 1987) are used in some comparisons.

Specimens in the zoological collections of Moscow and Kiev University Museums were used to analyse the wing pointedness of the Lapwing. Birds from Ukraine and the European part of Russia were measured. Male and female Lapwing have a marked difference in wing-formula, so the sexes were analysed separately.

For Oystercatcher we used data from Mitropolskiy (1962) who measured primary lengths in different age groups.

Results and Discussion

Young birds of all three species have significantly more pointed wings than adults (Table 1). Levin *et al.* (1991) found a similar pattern for the Little Ringed Plover *Charadrius dubius* in Kazakhstan during late summer, although their work is based on a different method of wing-formula calculation. In that study, young plovers had significantly more pointed wings than adults ($P<0.01$). The authors supposed this difference to be connected with more worn primary tips in adults. Wing-tip wear may also have affected our calculations. However, the indexes of adult Dunlin trapped during autumn and spring migrations were not significantly different (7.14±0.221 S.E., n=30; and 7.21±0.185 S.E., n=48 respectively) despite the different extent of feather wear. Similarly, there was no difference in the comparison of wing pointedness indexes of juveniles and first summer Lapwing, although these had fresh and very worn primaries respectively.

We also examined at what age wing pointedness reaches adult values. We compared wing pointedness indexes of second year Dunlin (7.02±0.174 S.E., n=30) and older birds (7.14±0.221 S.E., n=30) which were not significantly different. So, wing pointedness in Dunlin reached adult shape after the first complete moult (Figure 1).

In Oystercatchers, juveniles and non-breeding second year birds have similar wing pointedness indexes (Figure 2). However, it is not clear from the data in Mitropolskiy (1962) whether the second-year birds had time to moult their primaries, because the investigation was carried out in August at the White Sea. We assumed that they had moulted because of the known tendency of early complete moult in this age group of birds and because they had longer primaries when compare with juveniles (Figure 2). We believe that Oystercatchers probably only acquire adult wing-shape after the second complete moult but this has not been confirmed.

What is the biological significance of young birds having more pointed wings than adults? This phenomenon has already been described for some species of pigeons, hens, birds of prey and passerines (Tsvelikh & Dyadicheva 1986; Tsvelikh 1989) and the same explanation given, therefore we will only briefly summarise it here.

The more pointed the wing, the better its aerodynamic qualities and therefore, the better adapted it is for long-distance migration. Frequent take-offs and landings, and changeable flight height on the other hand makes less pointed wings more preferable. We believe that differences in wing

Table 1. Wing pointedness indexes (I) of some age groups of three wader species. .

Species	Age (sex)	n	I (±S.E)	P
Dunlin	1st year birds	70	8.28±0.121	0.001
	after 1st year birds	70	7.03±0.126	
Lapwing	1st & 2nd year males	11	-4.24±0.500	0.001
	after 2nd year males	13	-7.68±0.500	
	1st & 2nd year females	9	-0.27±0.379	0.01
	after 2nd year females	16	-4.24±0.350	
Oystercatcher	1st & 2nd year birds	-	12.0	
	after 2nd year birds	-	9.2	

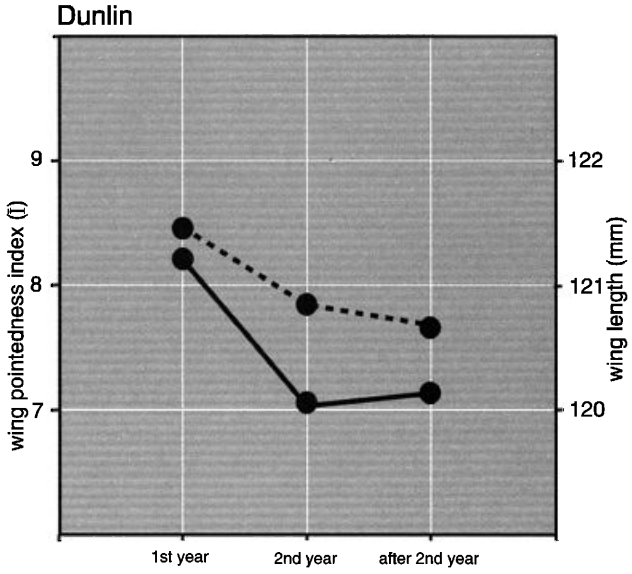

Figure 1. Age differences in wing pointedness index (solid line) and wing length (dotted line) in Dunlin.

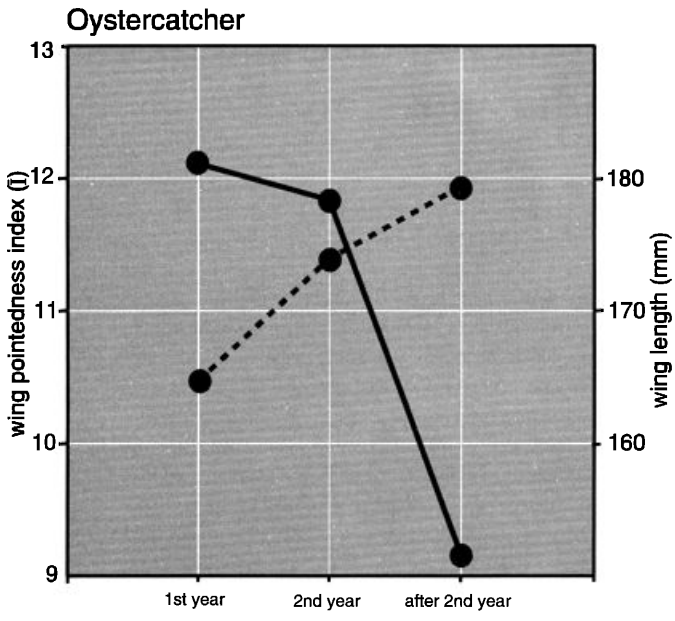

Figure 2. Age differences in wing pointedness index (solid line) and the length of 1st primary (dotted line) in Oystercatcher.

pointedness in young and adult birds reflect different flight strategies in these age groups. The more pointed wing either allows young birds to make longer journeys on migration or means they expend less energy covering the same distance as adult birds. Such a phenomenon is known for some species of birds, but in waders it has only been described for Lapwing (Dobrynina 1985).

During the breeding season displaying adults require a high degree of manoeuvrability. Reducing the aerodynamic quality of the wing, but improving the birds ability to perform these manoeuvres may improve its breeding success (Dolnik 1975). There may therefore be two reasons for juveniles having more pointed wings. Young, inexperienced birds making their first long-distance migrations need to use their energy as efficiently as possible because they are more likely to make mistakes, and adults may improve their breeding performance by having more rounded wings.

These differences in wing pointedness may help in the identification of the age in species which are lacking other age specific features. Age specific wing pointedness might also be used to indicate whether age-related differences exist in wader biology.

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